Application No. 10/606,107 Docket No. 20-0140C

REMARKS

Prior to the aforementioned Office action, claims 1-20 were presented for reconsideration and reexamination. In the Office action, the prior rejections were apparently withdrawn and all of the claims were rejected as allegedly unpatentable over a newly cited reference, a paper by Wolfe et al. entitled "Integrated CNI Avionics Using F-22 Modular Products." The Wolfe paper was applied under 35 U.S.C. §102(b) in rejecting claims 1-20. By this amendment, Applicant respectfully traverses the rejections and has amended the claims to distinguish the invention more clearly over the Wolfe paper. In particular, claim 17 has been cancelled, claims 1, 6, 9-11, 14, 16 and 18 have been amended, and new dependent claims 21-27 have been added, leaving 26 claims in the application.

Applicant notes with appreciation the Examiner's objections to claims 1, 6 and 14, which have been amended to correct the informalities pointed out by the Examiner. The Examiner's objections to the specification have been addressed by amending the opening section of the specification, which contains cross-references to related applications.

In response to rejection based on another informality, claim 11 has been amended to obviate the rejection made under 35 U.S.C. §112, second paragraph.

The Wolfe paper was published in 1996 and describes the state of the art of integrated CNI (communications, navigation and identification) avionics systems as used in the early to mid 1990s in such aircraft as the F-22 fighter. The inventors, as co-employees and (in the case of inventor Campbell) as a co-author of the cited paper,

were fully aware of this level of avionics integration but regarded it then, and still regard it, as a prior art approach upon which the present invention has improved significantly. Regrettably, the claims as filed and as amended thus far did not distinguish adequately over the prior art as exemplified by the Wolfe paper. It is hoped that this amendment will remedy this situation to the satisfaction of the Examiner.

What the Wolfe paper describes is a modular approach in which an avionics system is defined to include a number of "Line Replaceable Modules" (LRMs) or common modules, such as RF receivers and transmitters (each designed for operation over a particular narrow frequency range), signal processors, data processors and so forth. Figure 1 of the paper shows a generic integrated modular CNI architecture. The basic concept proposed in the Wolfe paper is that this generic architecture may be transferred to other "platforms," i.e., aircraft, by integrating a selection of the common modules to perform the desired functions on each new platform. Therefore, particular common modules that had been carefully designed, constructed and tested for reliable operation in performing a specific radio function could be utilized in a different configuration without redevelopment of those modules. Of course, if a new configuration called for a different radio function not specifically performed by an existing module, then a new common module would need to be designed or an existing one modified for this purpose. This approach obviously led to the need for a relatively large number of different common modules, from which a new radio system could be configured.

What the present invention does, in conjunction with related inventions in companion applications, is to advance the concept of modularity of avionics systems in

a very significant way, by defining modules that are much more generic in function than the common modules or LRMs of the Wolfe paper. The generic module in this new concept of modularity is the electronic radio system multifunction slice. A multifunction slice, one of which depicted in FIG. 1, provides all the necessary control and processing functions between an antenna and avionics components. Thus, the slice includes an antenna interface, RF processing associated with antenna signals, intermediate frequency (IF) signal processing, and baseband signal processing associated with avionics devices, and an avionics interface. In general terms, the slice comprises an antenna interface, a number of transceivers, at least one processor, an avionics interface, and various buses for signal communication within the slice and external to the slice.

The specification provides a chronology of this evolution of the modularity concept leading up to the present invention. As described in the "background" section extending from page 1, line 14, through page 4, line 22, the conventional approach to avionics design involved replicating many radio resources to achieve the desired functionality in various mission segments. Then, as described in the section beginning on page 5, line 1, and extending to page 5, line 14, avionics systems were designed from a number of "common modules," much as was described by Wolfe et al., but this approach also had its drawbacks.

An important aspect of this invention is the multifunction slice depicted in Fig. 1. Claim 1 as now amended defines the multifunction slice as comprising an antenna interface; a plurality of bidirectional transceivers, wherein each of the transceivers is

operable over a wide band of frequencies in order to support a wide range of radio function frequencies; a programmable processor coupled to the plurality of transceivers, to control operation of the transceivers and to process data transmitted and data received through the transceivers and operable to support at least two independent radio function threads through the plurality of transceivers; and an avionics interface including an avionics network input for receiving first data to be transmitted through the transceivers and an avionics network output for second data received from the transceivers.

Thus a slice is not simply a grouping of radio resources, as assumed by the Examiner, but is more in the nature of a generic building block that can be programmed to assume the role of a variety of radio functions. A key element of the multifunction slice is its transceivers. Unlike the specifically designed transmitters and receivers contemplated in the Wolfe paper, the transceivers in a multifunction slice are bidirectional, which is to say they can perform transmit and receive functions, either simultaneously or alternately, as called for, and they are operable over a wide band of frequencies, in order to be configured to perform a variety of radio functions. The processor that is also part of the multifunction slice performs all the functions needed to control operation of the transceivers.

As defined in claim 6, for example, multiple multifunction slices may be combined to provide a multifunction electronic radio system. A key aspect of this concept of modularity is that multifunction slices of identical or nearly identical design can be

incorporated into a radio system and configured to perform any combination of desired avionics functions.

Another key aspect of the multifunction slice design is that it includes multiple transceivers that are essentially generic in design. That is to say, each transceiver is a single module operable simultaneously, or alternately, in transmit and receive modes, over a wide band of frequencies, in order to support a wide range of radio function frequencies. The transceivers are described as such in the specification, for example in the paragraph beginning on page 9, line 13. The Examiner contends that a transceiver is functionally equivalent to the individual transmitters and receivers broadly disclosed in the Wolfe paper. As should by now be apparent, the present invention requires that the transceivers be essentially generic, in the sense that each of them may be configured for operation at any desired frequency over a wide band of frequencies, and for simultaneous operation in transmit and receive modes.

The Examiner has based the rejections in part on the assumption that a "slice is read in accordance with the language in the specification to simply mean a grouping or radio resources." Applicant maintains that this assumption is an overgeneralization of the term "slice" not consistent with its usage in the specification, where the term is defined much more narrowly, as discussed above. In particular, it is key to the invention that the multifunction slice must contain a plurality of transceivers (configurable to perform transmit and receive operations over any of a wide band of frequencies), and a processor (configurable to perform all the functions necessary for controlling the transceivers, for performing signal processing within the slice and for effecting

communication with other slices). The Wolfe paper simply does not rise to this level of generic modularity and is concerned only with reconfiguring specific hardware modules in new combinations, to adapt these modules for operation on a different platform.

The independent claims (1, 6, 11 and 16) have been revised in an effort to define the distinctions discussed above more clearly, and to distinguish the claims more clearly over the cited Wolfe paper. In claim 1, the terms "first data" and "second data" have been simplified to recite only "data," since the original designations "first" and "second" served no purpose in the claim. Further, in claim 6 the definition of each multifunction slice has been clarified to include a data interface as well as an antenna interface. Also, the subparagraph that begins "wherein the plurality of multifunction slices ..." has been relocated to the end of the claim and moved out of the definition of a single slice, since it pertains to radio system as a whole rather than to a slice without the radio system. Finally, the other "wherein" clause, which begins "wherein at least one of said transceivers ..." has been amended to correct an error in the original form of this subparagraph. (Each slice contains a plurality of transceivers but only one antenna interface and the original claim language was inconsistent with this fact.)

Claim 9 has been revised to recite "a general input/output structure" described in terms consistent with those used in describing the avionics bus 226 in the specification (page 13, lines 7-11).

Claim 10 has been amended to include an inter-slice network bus connector in each multifunction slice, to clarify how multifunction slices are interconnected.

Claim 11 has been amended as indicated above, and also to define each multifunction slice as including a "data interface," a term that is more general than an "avionics interface." The method defined by this claim is, of course, not necessarily limited to avionics systems.

Claim 16 has been amended to include all the elements of each multifunction slice, since these elements are believed to distinguish the invention more clearly over the cited art.

Claim 17 has been cancelled because its features are now incorporated into amended claim 16.

Claim 18 has been amended to clarify the function of a master processor recited in the claim.

New claim 21 adds an inter-slice network bus connector to the multifunction slice of claim 1.

New claims 22 and 23 add as new features to the radio system of claim 6, a radio network bus and an external control bus, respectively.

New claims 24 and 25 add as new features to the method of claim 11, interconnecting slices over a radio network bus and transmitting control signals over the radio network bus, respectively.

New claim 26 adds as new feature to the method of claim 11, directly controlling electronic radio system components external to a multifunction slice by transmitting control signals over an external bus coupled to the programmable processor of at least one of the electronic radio system multifunction slices.

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New claims 27 and 28 add as new features to the aircraft radio system of claim 6, a radio network bus and an external control bus, respectively.

Applicant regrets the need to add new dependent claims 21-28 at this stage of the prosecution but respectfully submits that the additional features they define, namely an inter-slice bus and an external bus, are important aspects of the present invention that are worthy of patent protection. Moreover, the additional features defined by these claims more clearly distinguish the slice-based architecture of the invention from the prior art relied on by the Examiner.

The claims are, therefore, submitted for reconsideration in light of these remarks. Withdrawal of the rejections and allowance of the application are respectfully requested.

Respectfully submitted,

Date: February 7, 2005

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